DOCUMENT RESUME

ED 063 860 HE 003 092

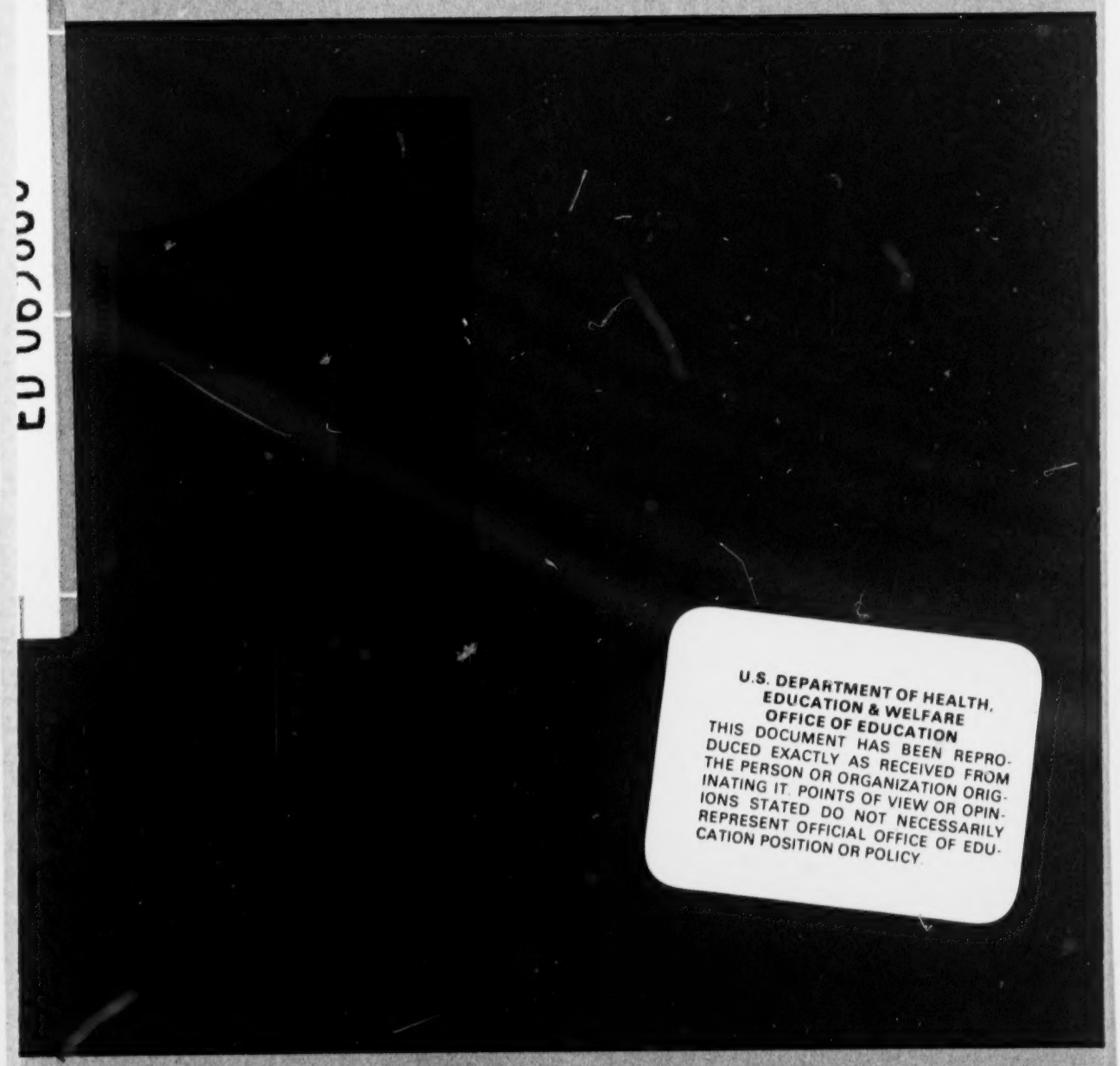
AUTHOR	Farmer, James
TITLE	Why Planning, Programming, Budgeting Systems for Higher Education?
INSTITUTION	Western Interstate Commission for Higher Education, Boise, Idaho.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C.
REPORT NO	R-1
PUB DATE	Feb 70
CONTRACT	OEC-0-8-980708-4533(010)
NOTE	28p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Budgeting; *Educational Administration; Educational Finance; *Educational Planning; *Higher Education; Management; *Management Systems; Money Management; Planning

ABSTRACT

Planning, programming, budgeting systems (PPBS) require extensive investment on the part of institutions of higher education. But there is pressure from public agencies and the public in general for higher education to explore and use these techniques for improved management. The new environment for higher education includes competition with other social programs for funds, an interdependent economic system, and the acceptance of PPBS by federal, state, and local governments, and by business. A PPBS formulation can provide additional insight into program changes by identifying resource requirements and developing costs by program tends to improve understanding of objectives and outputs. Three methods of implementing of PPBS are listed in the present document: planning studies, evolutionary development of PPBS, and the "turn-key" changeover to PPBS. This paper concludes that an institution should begin implementation of PPBS cautiously, but that the PPBS technology would be useful to college administrators in developing their management art. (Author/HS)

WHY

Planning, Programming, Budgeting Systems for Higher Education?



U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

Number 1 in a series of monographs prepared especially for College and University Presidents by the

Management Information Systems Program

1

Executive Director: WICHE
Robert H. Kroepsch

Associate Director, WICHE, and
Director, Planning and Management
Systems Division:
Ben Lawrence

The Western Interstate Commission for Higher Education (WICHE) is a public agency through which the 13 western states work together

. . . to increase educational opportunities for westerners.

. . . to expand the supply of specialized manpower in the West.

. . . to help universities and colleges improve both their programs and their management.

. . . to inform the public about the needs of higher education.

Program Director for Development and
Applications Unit:
Warren W. Gulko

Program Director for Training Unit:
Robert Huff

Program Associate for Information Systems:
Charles R. Thomas

Program Associate:
John Minter

The program of the WICHE Planning and Management Systems Division was proposed by state coordinating agencies and colleges and universities in the West to be under the aegis of the Western Interstate Commission for Higher Education. The Planning and Management Systems Division program proposes in summary:

To design, develop, and encourage the implementation of management information systems and data bases including common data elements in institutions and agencies of higher education that will:

- provide improved information to higher education administration at all levels.
- facilitate exchange of comparable data among institutions.
- facilitate reporting of comparable information at the state and national levels.

This publication is in the public domain in accordance with the U.S. Office of Education Contract No. OEC 0-8-980708-4533 (010).

WHY PLANNING, PROGRAMMING, BUDGETING SYSTEMS FOR HIGHER EDUCATION?

By

James Farmer

Western Interstate Commission for Higher Education

P. O. Drawer P Boulder, Colorado 80302

February, 1970

3

Second printing, October 1970

FOREWORD

A major problem in the application of modern management techniques to institutions of higher education is that of providing a clear understanding of the nature of the new techniques, their advantages for decision-making, their approximate costs, the effects of their use, and how they are to be implemented. This monograph, the first of a series, provides a clear understanding of one aspect of modern management techniques. "WHY PLANNING, PROGRAMMING, BUDGETING SYSTEMS FOR HIGHER EDUCATION?" It is written for the layman; it describes PPBS in higher education as opposed to PPBS in industry or defense. It provides examples of the kind of results PPBS can be expected to provide higher education.

The author, Mr. Farmer, is thoroughly acquainted with planning, programming, and budgeting systems in the federal government and the defense industry as well as higher education. He understands the conceptual difficulties involved in applying the PPBS techniques to institutions of higher education. He warns of the deficiencies of PPBS for higher education and admits that, ". . . at some point program budgets can become an exercise rather than a useful management tool."

But the case for exploring thoroughly the use of PPBS in higher education is well founded. Unfortunately, its advantages are not casually obvious. One must struggle with its concepts until they are understood. All too frequently these fundamental concepts of PPBS have been buried in systems lingo and computer jargon. This monograph, and the series to follow, are designed to provide college and university officials with additional understanding of PPBS and other new management techniques. You are encouraged to read this carefully, giving special attention to the examples.

Ben Lawrence, Director
Management Information
Systems Program

Boulder, Colorado
February, 1970

SUMMARY

Planning, programming, budgeting systems require extensive investment on the part of institutions of higher education. But there is pressure, from public agencies and the public in general, for higher education to explore and use these techniques for improved management. The "new environment" for higher education includes competition with other social programs for funds, an inter-dependent economic system, and the acceptance of PPBS by federal, state, and local governments, and by business.

However, PPBS has several conceptual deficiencies when applied to institutions of higher education. There has been no fully satisfactory definition of the output of higher education. In institutions there is no single organizational unit which produces a unique output—a graduate is the product of many different academic departments and the recipient of many different services. There are no accepted production functions for higher education, and because of the joint input and output of programs like research and instruction, production functions for higher education will be difficult to identify or quantify.

A PPBS formulation can, however, provide additional insight into program changes by identifying resource requirements, and developing costs by program tends to improve understanding of objectives and outputs. Several examples are given.

Three methods of implementing PPBS are listed: planning studies, evolutionary development of PPBS, and the "turn-key" changeover to PPBS. This paper concludes that an institution should begin implementation of PPBS cautiously, but that the PPBS technology would be useful to college administrators in developing their management art.

WHY PLANNING, PROGRAMMING, BUDGETING SYSTEMS FOR HIGHER EDUCATION?

The Problem

Many college and university presidents are facing the decision of implementing planning, programming, and budgeting systems. The decision to use such a system requires a significant commitment of resources with an uncertain return. It requires the allocation of already limited analytic talent. And there are a few cases of fully satisfied users.

At the same time, there is increasing demand from public agencies and private advisors that PPBS, as it is often called, be immediately implemented.[1] Several state colleges and universities are facing requirements by state legislators or finance departments to report in program budget formats. Are these demands reasonable?

Clearly, PPBS must improve the decision-making process markedly to make the investment in PPBS and the related management technology viable. PPBS must, as it requires of the programs themselves, pass the test of cost-effectiveness.[2]

The New Environment

It is important to understand the "new environment" of higher education in order to understand the motivation of those outside the higher education community to strongly support PPBS. First, higher education is now competing with many significant social problems for funds. Second, higher education is now a closed economic system—

---

[1]For an example, see the Legislative Analyst's Report, California Joint Budget Committee (Ref. 1, p. 417). For comments on congressional concern, see Steiner in Novick (Ref. 2, pp. 314-316).

[2]For a theoretical discussion of the economic value of an information (decision-making) system, see Marschak's model (Ref. 3 and 4).

there are no independent institutions. Third, there has been an acceptance and use of program-budgeting by the federal, state, and local governments, and by business.

For many years higher education has presented the "bill" for higher education to the public for support, and it usually was paid. Now, however, bond authorizations are frequently defeated at the polls, and state governments are drastically reducing per student funds.[3] Although higher education used only 2.2 percent of the gross national product in 1965-1967, the expenditures totaled $15.2 billion. By 1980 higher education will be consuming 2.5 percent of the GNP—some $32.5 billion (1967 dollars).[4] The public now has a large number of social programs—hunger, housing, medical care, transportation, and pollution—competing for public funds. Educators are being asked to specifically describe their objectives, measure their performance, and determine costs.

The public could readily understand one of higher education's arguments—that education was an investment in the *economic* future of the community. Hirsch described this objective saying:

> . . . education is an investment designed to produce an enterprising and skilled labor force that can be counted on to contribute to economic growth, prosperity, technological advances, and national security. Education enables people to hold rewarding jobs and in turn provides the nation with economic and military strength.[5]

But in the "search for relevance," students are turning from engineering, medicine, and business to ethnic studies, social science, and political science. The public appears to have difficulty finding a direct relationship between these studies and any economic goals cited by the institutions.

It is reasonable that public representatives would now ask for program budgets hoping to get an explicit statement of objectives, measures of effectiveness, and costs by program.

---

[3]For a California example, see the Governor's 1970-71 budget goals for the California State Colleges in Ref. 5.

[4]These data, based on 1967 constant dollars, were taken from Tickton, Ref. 6, p. 22.

[5]Ref. 2, pp. 180-182.

Higher education is now a closed economic system in two senses. First, no institution is completely independent of another. Enrollment and funding of almost all institutions are determined, in part, by the actions of other institutions. This dependence is most evident in the large systems. For example, as the University of California and the California State Colleges began to deny admission to entering freshmen and sophomores, the California Community Colleges had an enrollment surge which would never have been projected by historical statistics. Several states have begun to fund education at private institutions, and almost all institutions, or their students, receive funds from the federal government. Thus, planning must include the effects of these dependencies as well as historical patterns of enrollment and funding.

In a second sense, colleges and universities are considered an integral part of the community's social and industrial base. Some colleges have been created to provide the "technology" for a community's industry, or in an attempt to cause social change. The institution of higher education must then be considered in the context of the economic and social system. The planning system must represent this close interrelationship.

If program budgeting had been discredited, or found inapplicable by business, higher education could have avoided PPBS. But this management technology, developed from science, engineering, and economics, is proving its usefulness. Failing to implement this technology and at the same time failing to articulate its inapplicability, higher education, as a whole, appears to be resistant to change—the very "change" that such institutions are expected to foster. While it is clear to the systems analyst that higher education presents difficult conceptual problems. the reluctance of institutions to approach such planning technology appears unwarranted.

Perhaps Hirsch was more bold than understanding when he said:

> The existing budget and budgeting procedures are so patently uninformative that they effecively conceal most of the needed insight. Many old-timers are quite comfortable in such a situation, which makes it difficult for any operation to be judged and evaluated seriously.[6]

---

[6]Ref. 2, p. 205.

Fear of the unknown policy changes which may be imposed on institutions using program budgeting may be the greatest deterrent to its use.[7] No organization can be comfortable when there is a re-examination of basic objectives and an evaluation of institutional performance.

Already, however, institutional objectives are being challenged by students, faculty, and the public. Institutional effectiveness is being questioned by the government, foundations, and private donors. Clearly there will be changes, yet there are few sincere explorations by institutional administrators of the quantitative techniques which offer some hope of planning for these changes. There is also some concern that program budgeting will result in increased federal control. Hirsch commented:

> Effective program budgeting by the U. S. Office of Education could strengthen the hand of this agency not only in relation to other parts of the Federal government concerned with education, but also in relation to state and local government. Program budgeting might force the latter to move in a similar direction, especially if federal aid would include such a direct or indirect requirement.[8]

But Hirsch may be more enthusiastic than realistic. Some ten years after program budgeting was implemented on the federal level, virtually no institutions of higher education have viable program budgets. There is little evidence that full program budgeting can be implemented in the next few years.

In this "new environment," however, the higher education community has little choice except to explore PPBS and similar planning systems, or lose their credibility as legitimate managers of a vital social function.

---

[7]There is a significant danger from misinterpretation of the data generated from program budgeting. Legislatures and control agencies could impose counterproductive changes through misunderstanding. Adequate presentation and analysis of the data to the public agencies will be particularly important for institutions during the early exploratory phases of a program budget implementation. The problem was not significant for the Department of Defense since most program budgets were classified and hence not publicly available.

[8]Ref. 2, p. 205.

Definition of PPBS

Before continuing, it may be useful to review exactly what PPBS is. In a general sense, PPBS is a system for:[9]

- Planning—the selection or identification of the overall, long-range objectives of the organization and the systematic analysis of various courses of action in terms of relative costs and benefits.

- Programming—deciding on the specific courses of action to be followed in carrying out planning decisions.

- Budgeting—translating planning and programming decisions into specific financial plans.

Hence, the PPB system includes major planning functions and uses the budget process for the development of a short range financial plan to implement the planning and programming decisions.

A budget is traditionally viewed as direction to the institution for discharging a fiduciary responsibility—an accounting of funds spent. But such line-item budgets provide little substance for a useful dialogue on the issues of higher education. Although expenditures are divided into classes, say wages and salaries, operating expenses, equipment, and capital expense, there is little useful comparison to other institutions which have a different mix of output, or to the past because the outputs of higher education are constantly changing. Having neither comparisons nor identifiable program costs, the line-item budget, in its pure form, has little value for management, or for presentation of new programs.

The basic concept of program budgeting is to focus on output and choose the combination of input resources which best accomplishes that output. It is this aspect of program budgeting which perhaps concerns administrators most. Legislatures have frequently tried to exercise control of an institution through a line-item budget. This is generally unsuccessful and uncomfortable because resources are not related to specific programs. Using program budgeting, the administrators are expected to understand and accept mutually agreed upon objectives and then expend the funds on whatever mix of resources

---

[9]These definitions were taken from the General Accounting Office Glossary, Ref. 7. For more general definitions and discussion, see Haggart, *et al.*, especially Sections I, II, and III, Ref. 8, or Greenhouse in Ref. 9.

best accomplishes those objectives. "Fiscal flexibility" is a requisite for management under PPBS. There are several assumptions implicit in a program budget. These should be specifically noted:

- That management has the *authority* to choose the course of action, or alternative, to accomplish the stated objectives, and has the *responsibility* for choosing the best course of action. The program budget is not a mechanism for enforcing a predetermined course of action, but rather of identifying the level of available resources made available to accomplish program objectives.

- Planning and programming are a systematic process which can formulate resource requirements for alternative courses of action and compare these courses in terms of the objectives.

In practice these assumptions are violated to some extent, and at some point, program budgets can become an exercise rather than a useful management tool.

Planning and programming—a two step decision process—represent the substance of PPBS. Budgeting is the mechanism for implementation and control, not for basic decision-making. Planning requires a specific statement of institutional objectives, the development of alternative courses of action, and an analysis of these alternatives. Planning requires creativity in order to provide innovative alternatives and requires a well developed analytic capability to adequately analyze the results of these alternatives. Programming requires a detailed understanding of these courses of action in order to provide specific time schedules, coordination with other institutional programs and identification of the personnel, material, and financial resources to be used.

Thus PPBS is not merely a technique but rather represents an organization of people and equipment applying a technology to the management of an institution. An organization using PPBS must place responsibility for the four steps of PPBS—Planning, Programming, Budgeting, and Control—with specific organizational units, provide the procedures for their interrelationship, and be dedicated to management of that organization through this specific process. The technology provides methods of measurement, analysis, and presentation. It is not

a system but rather a component. The technology rests with the individuals having specific competence, not with computers, forms, or organizational charts.

Only when PPBS is viewed as a management method—an organization and its procedures—is it possible to view PPBS in the proper perspective.

Deficiencies of PPBS for Higher Education

There are significant conceptual problems in implementing PPBS for institutions of higher education. First, it is difficult to identify the outputs of higher education. Some analysts have used degree winners, number of courses completed, or student credit hours as output proxies. Others, concerned with the economic value of an education, have used salary differentials between entrance and exit to the institution. None are fully satisfactory and most fail to consider the "quality" of education.

It may be even more difficult to define research output, or the results of public service. The lack of quantitative measures of output is the most severe handicap for implementing PPBS in higher education.[10]

Second, there is no single organizational unit which produces a unique output. The physics department, for example, does not itself produce a physics degree. Other departments contribute to that output. Similarly, the physics department expends resources on non-physics majors. Program budgeting techniques are applied with less difficulty when organizational units contribute to a single, measurable output.

Third, production functions for higher education are not known. While there has been considerable research on the education process, there has been no accepted algorithm for determining the resource requirements for a unit of output. Thus, higher education is not fully amenable to the formal economic analysis applicable to business. Also, the output of higher education—research and instruction—are frequently joint outputs, and the resources are used jointly—as, for

---

[10]For a discussion of the problem, see Keller, Ref. 10.

example, instructors and graduate students working on research—without a clear distinction between their contributions.

Uses of PPBS

If PPBS has so many deficiencies, is it useful for higher education? While that question should be answered in the context of the specific institution, PPBS does have significant potential for institutional management.

Three examples are given here. The first example will use PPBS data to develop a five-year budget for a growing state college adding an engineering curriculum. Both line-item and program budget formats are given. The second example illustrates how a shift in curricular demand by students affects the various departments, although the total resource demand is not significantly changed. The third example uses output results of the first example to examine policy and budget interactions.

Examples such as these must be grossly simplified in order to clearly illustrate the points. However, the data used are similar to actual observations. The results, then, could approximate actual budgets, or policies. However, institutions of higher education are complex and have many driving forces, so such results could not be so readily identified in a real institution.

The first example is an institution of 2,000 FTE students, offering courses in liberal arts and business, and increasing in size about 50 percent per year. In 1972 an engineering degree program will be initiated.[11] The traditional budgeting approach is given in Table 1. Average cost per FTE is used to project the total budget. (This is equivalent to giving "workload increases" by increasing the budget proportional to FTE increase.) The total budget is distributed over the traditional line-items—faculty, library, plant operations, support services, student services, financial aid, and other. Usually these categories would be broken down into salaries and wages, operating expenses, equipment, and miscellaneous. There are several implicit assumptions in this budgeting process: (1) all instructional programs

---

[11]All data are based on the California State Colleges. Cost data is from Ref. 11 though values used here may differ somewhat from the final published thesis. Enrollment data are obtained from Ref. 12, 13, and 14. The growth rate parallels a new urban state college.

Table 1

FIVE-YEAR LINE-ITEM BUDGET
GROWING STATE COLLEGE EXAMPLE

		1970	*1971*	*1972*	*1973*	*1974*
Enrollment, FTE*		2,050	3,001	4,393	6,432	9,417
Allocated Cost per FTE		1,160	1,160	1,160	1,160	1,160
Total Budget**		2,378,000	3,481,000	5,096,000	7,461,000	10,924,000
Faculty ***	46.3%	1,101,000	1,612,000	2,359,000	3,454,000	5,058,000
Library	9.5	226,000	331,000	484,000	709,000	1,038,000
Plant Operations	7.9	188,000	275,000	403,000	589,000	863,000
Support Services	20.7	492,000	721,000	1,055,000	1,544,000	2,261,000
Student Services	12.9	307,000	449,070	657,000	962,000	1,409,000
Financial Aid	0.6	14,000	21,000	31,000	45,000	66,000
Other	2.2	52,000	77,000	112,000	164,000	240,000

*Growth rate of 46.4 percent per year.

**1968 constant dollars—no allowance for price increases.

***Because of rounding in multiplication, totals may not add. Cost allocations based on Ref. 11.

Table 2

FIVE-YEAR PROGRAM BUDGET
GROWING STATE COLLEGE EXAMPLE

		1970	*1971*	*1972*	*1973*	*1974*
Enrollment, FTE*		2,050	3,001	4,393	6,432	9,417
Liberal Arts	40%	820	1,200	1,677	2,413	3,447
Business	60%	1,230	1,180	2,516	3,619	5,170
Engineering		—	—	200	400	800
Cost per FTE						
Liberal Arts		800	800	800	800	800
Business		1,400	1,400	1,400	1,400	1,400
Engineering		1,900	1,900	1,900	1,900	1,900
Average		1,160	1,160	1,194	1,206	1,223
Total Budget		2,378,000	3,481,000	5,244,000	7,757,000	11,516,000
Output						
FTE Student Years		2,050	3,001	4,393	6,432	9,417
Degree Productivity Index		.48	.48	.48	.48	.48
Degree Equivalents (4 year)		246	360	527	772	1,130
Cost per Degree Equivalent		9,700	9,700	9,900	10,000	10,200

require identical resources, (2) the methods of instruction will not change, and (3) costs are dependent only on the *number* of students.

Table 2 is a Five-Year Program Budget for the same example. This budget has two significant differences from the line-item budget. Cost estimates are based on FTE students by degree program, recognizing that different degree programs require different resources. Output is specifically identified by FTE student years and degree equivalents. The cost per degree equivalent represents one measure of cost-effectiveness for that institution. The total budget exceeds the estimates of the line-item budget because of the higher cost engineering instructional program. Because of using cost by degree program, the PPBS formulation can be a better estimator of cost than the average FTE cost per year.

The first example showed an institution facing a period of rapid growth which used a simple PPBS concept to develop a five-year cost estimate. But institutions can have rapid changes of degree program demand by students without enrollment changes. The second example identifies the consequences of a change occurring within an institution by the current "search for relevance." In this case some students changed majors from English and history to government and social relations.[12]

Table 3 shows the enrollment shifts by degree program caused by the changes in student demand. Table 4 shows the aggregate cost increments and Table 5 gives the traditional line-item display. There are some potential savings from the overall decrease in enrollment, but no significant impact of change is evident.

Table 3

DEGREE PROGRAM DEMAND SHIFT

FULL-TIME STUDENTS

Major	*1966-67*	*1968-69*	*Change*	
English	494	367	—127	—26%
Government	446	562	+116	+26%
History	576	422	—154	—27%
Social Relations	337	418	+ 81	+24%
Total	1853	1769	— 84	— 3%

[12]For an example of such an enrollment shift, see Ref. 15.

Table 4

RESOURCE INCREMENT
DEGREE PROGRAM DEMAND SHIFT EXAMPLE

Degree Program	*FTE Shifts*	*Cost per FTE*	*Dollar Costs*
English	—127	$1,472	—187,000
Government	+116	1,859	+216,000
History	—154	2,192	—338,000
Social Relations	+81	1,871	+152,000
Total	—84		—157,000

Table 5

LINE-ITEM BUDGET INCREMENTS
DEGREE PROGRAM DEMAND EXAMPLE
(Decrement of 84 FTE)

Budget Category	*Percent*	*Budget Decrement*
Faculty	46.3%	72,000
Library	9.5	15,000
Plant Operations	7.5	12,000
Support Services	20.7	32,000
Student Services	12.9	20,000
Financial Aid	0.6	1,000
Other	2.2	4,000
Total		156,000

Most program budgeting systems for higher education have had to relate degree programs (output) to the resources used in academic departments (input). Unlike some other PPBS applications where organizational entities contribute to a unique program, higher education applications have had to develop "cross-over" matrices relating the contribution of departments to degree programs. Weathersby used an induced course load matrix, and Young used a program cost contribution matrix.[18] Table 6 was prepared using Young's PCCM, and shows the effect on *departments* as a result of the change in student *demand*.

---

[18]For the Weathersby formulation, see Ref. 16, pp. 20-28. For the Program Cost Contribution Matrix at San Fernando Valley State College, see Ref. 11. Springer, in Ref. 17, describes the relationship between the two formulations.

Table 6

RESOURCE IMPLICATIONS BY ACADEMIC DEPARTMENT*

Degree Program	*English*	*Government*	*History*	*Social Relations*	*Total*
	—127 FTE	+116	—154	+81	—84
Department					
Education	—30,000	+14,000	—60,000	+21,000	—55,000
Art, Music and Drama	—13,000	+12,000	—15,000	+10,000	—6,000
Foreign Languages	—10,000	+7,000	—12,000	+4,000	—11,000
Geography	—3,000	+6,000	—20,000	+3,000	—14,000
English	—*83,000*	+12,000	—23,000	+7,000	—87,000
History	0	+22,000	— *114,000*	+5,000	—87,000
Government	—2,000	+*70,000*	—15,000	+3,000	+56,000
Social Relations	—3,000	+5,000	—5,000	*56,000*	+53,000
Ethnic Studies**	—2,000	+2,000	—4,000	+5,000	+1,000
Other***	—41,000	+66,000	—68,000	+38,000	—5,000
Total	—187,000	+216,000	—336,000	+152,000	—156,000

*Program contribution coefficients from Ref. 11.

**Ethnic studies department included to show the small increase, caused by "the search for relevance."

***Seventeen departments showed a change of less than $5,000 each, and totaled only—$5,000.

The impact on the four major departments—English, government, history, and social relations—is not as significant as would be expected from the dollar cost levels shown in Table 4. For example, the loss of 154 history majors, a dollar cost of $336,000, "saves" the history department only $114,000. The remainder of the cost for history majors is in other departments, and the overall impact of the major shifts for the history department is only $87,000 because government majors take a number of history courses. The strong impact on the education department is not evident from traditional analysis. The reduced demand is equivalent to $55,000. Both foreign languages and geography showed some change—$11,000 and $14,000 respectively. It is also interesting to note that the "search for relevance" and the concomitant major changes cause almost no change in the demand for ethnic studies by the students. These kinds of changes are not predictable from line-item budgets, but are clearly evident in PPBS results.

This example showed the resource effects of a change in student demand, a parameter not under the control of institutional administration. These effects are more clearly identified by the program budget format (Table 6) than the traditional line-item format (Table 5).

There has been no general accepted measure of the output of higher education. It appears though that any output measure will have several components. Viewing higher education as "immersion" in an intellectual environment, then the number of years attending an institution can be used as a measure of "exposure." Viewing higher education as a series of courses contributing to knowledge, then the number of courses, weekly class hours, or some similar unit becomes a measure. Viewing higher education as progress toward a degree, then the number of degrees awarded becomes a measure of output. Whatever output measure is finally developed and accepted, it will probably have components similar to those listed. It can be useful, however, to look at the consequences of using these measures of output.

In order to use degrees as an output, it is useful to consider the amount of resources minimally required for a degree as compared to the amount of resources actually used to produce a degree. The resulting coefficient could be a measure of effectiveness and might be called

---

[14]It is interesting to note that the data to compute this value, even on a gross national basis, is not available. This estimate for 1966 was made using Tables 157

a degree productivity index. It appears that the national average for undergraduate education is somewhere between 0.40 and 0.50.[14] That is, an institution must produce some 250 to 300 weekly credit hours in order to produce an undergraduate degree.

Using this degree productivity index, the degree equivalents were computed for the first example and shown on Table 2. The cost-benefit ratio was then expressed in cost per degree equivalent.

Using the data from the first example, consider alternative policies for a budget constrained institution. Assume that the state college was limited to $3,000,000 for 1971, and that unit costs given apply. The theoretical enrollment mixes are shown in Fig. 1. With a $3 million budget, the enrollment can vary from 3,750—all liberal arts students—to 2,143—all business students. Not all theoretical mixes may be achieved, and many are undesirable even under a constrained budget. Most institutions would elect to accept all returning students. This would mean that 820 business students and 615 liberal arts students returned, and maximum enrollment of 3,135 would be achieved by accepting 1,700 liberal arts students. Several enrollment policies and the resulting number of students which could be accommodated are given in Table 7. Although it may not be possible, because of faculty and facilities, to change enrollment policies and mix of student majors abruptly, it is interesting to note the wide variances in the number of students which can be accommodated as a function of *their* choice of discipline. The question of whether 3,750 liberal arts students are "better" than 2,143 business students is one which unfortunately must be answered with current constrained budgets.

Table 7

POSSIBLE ENROLLMENTS, CONSTRAINED BUDGET

Policy	*Liberal Arts*	*Business*	*Total*
Maximum student enrollment	3,750	0	3,750
Maximum new student enrollment	2,315	820	3,135
Restricted business enrollment	1,200	1,451	2,651
Traditional mix	1,034	1,551	2,585
Maximum business	0	2,143	2,143

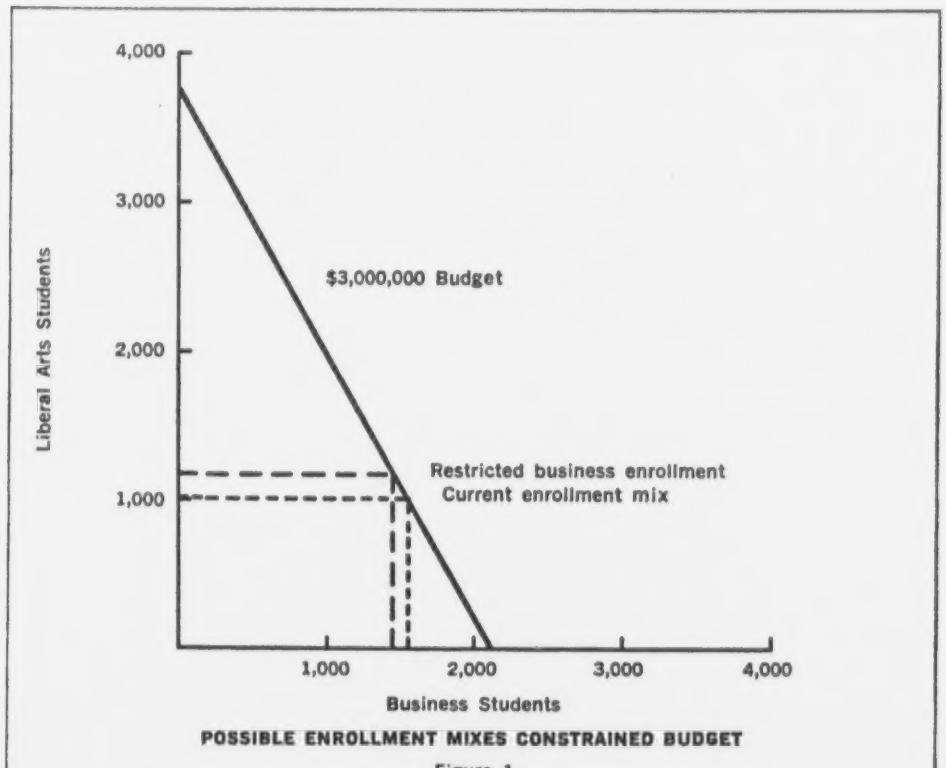
---

and 165 of Ref. 13 to estimate undergraduate FTE as a function of head count, and Table 162 to estimate the number of degrees/FTE. This was corrected for a four-year program yielding about 0.48. Using Ref. 12, the estimated value for the California State Colleges would be between 0.5 and 0.8 depending on the amount of transfer credit from junior colleges.

This example can also be extended to show the effects of the degree productive index. Figure 2 shows the cost for an engineering degree as a function of the degree productive index. This cost varies from $38,000 per degree at 0.2 to $9,500 at 0.8. For the first example, a productive index of 0.48 yielded a cost of $15,000 per degree.

If degrees rather than number of student courses is the criteria, then counseling and guidance, and remedial or supplementary training, may be very important to *reduce* the average cost per degree. With this measure of output, or this measure in conjunction with exposure or number of courses taken, a direct dollar value for these student services can be derived as a function of the change in the degree productive index.

These examples were intended to illustrate some of the types of analysis which are possible using program budgeting techniques. Many significant variables have been omitted, and all of the conditions illustrated would be operating simultaneously. Furthermore these examples did not show the effects of time and transition. Such factors as faculty tenure and specialized facilities and equipment may cause



POSSIBLE ENROLLMENT MIXES CONSTRAINED BUDGET

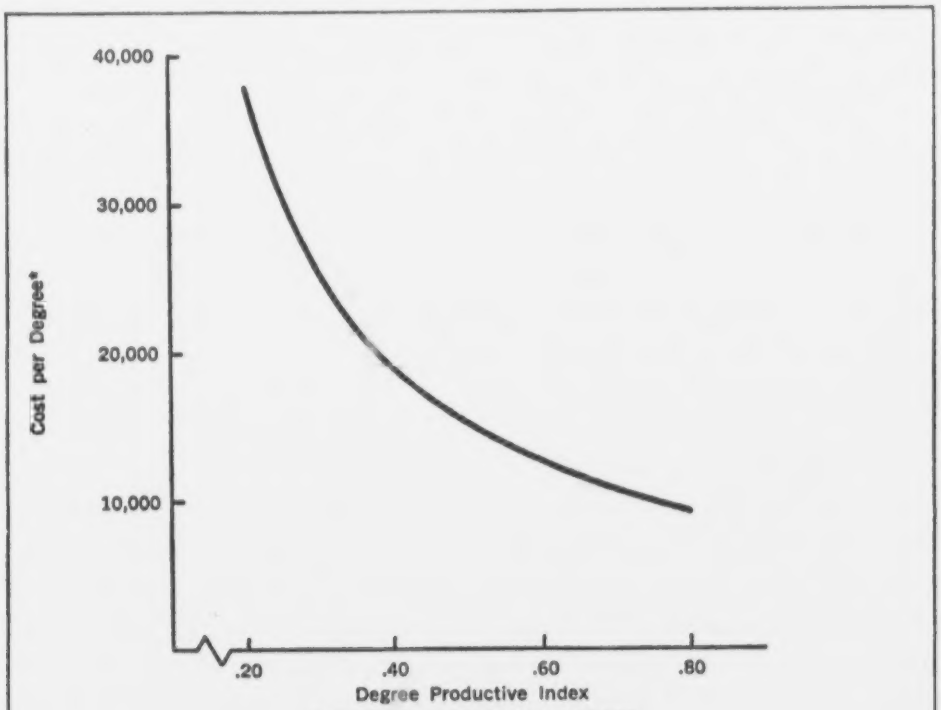
Figure 1

either increased institutional costs through a transition period, or constrain the alternatives available to the institution.

The line-item budget cannot, itself, be used to reflect the resource requirements caused by these changes, or to project resource requirements into the future since it does not relate input to output. The line-item budget and "workload" increases have many assumptions of linearity and small incremental change, and may, because of their structure, preclude change in the mix of organizational activities or methods of instruction or research. While institutions with line-item budgets have had to cope with change, it has been done on an ad-hoc basis exogenous to the budget process.

Implementing PPBS

If an institution elects to be a participant rather than an interested spectator, there are several levels of participation. These include special planning studies using PPBS techniques, an evolutionary implementation which supplements traditional planning methods with PPBS-type studies and parallels the current budgeting system with a program



COST PER ENGINEERING DEGREE
Figure 2

*Based on $1,900 per year for a four-year degree program.

budget, or a "turn-key" conversion to PPBS with the concomitant changes in procedure and organization. Since PPBS may lead to significant organization change, it may be advantageous for an institution to progress through the levels of participation until, through evolution, a full PPBS system has been installed.

The components of PPBS include an organization, the technology, some data processing service, and an organization policy of implementation. The organization must include the functions of planning, programming, budgeting, and evaluation. These may be combined into a single PPBS unit, separated into two or more organizational units, or delegated to existing organizational units. The technology resides in the analytic talent of the professional staff, and the success of the PPBS approach correlates highly with the quality of this talent. Some data processing service is necessary to use the quantitive management techniques. Also automatic data processing significantly reduces the cost and improves the timeliness of the PPBS system by having machine readable data bases.

A vital component of an operable PPBS is an organization policy which demonstrates that decision-makers intend to use the results of PPBS. If the results are ignored, the system loses its credibility, and with that loss, its support.

As a method of implementation, a planning studies unit could perform special planning studies to tackle significant problems and to give the staff an opportunity to learn about the technology as well as the results. There is a serious constraint on such studies. Since no change has been made in the reporting system, data base, or organization, the necessary data may not be available for the specific problems given to the planning studies unit.

The PPBS could also be implemented by creating a Vice-President for Planning or a similar position. A planning office, a program office, a budgeting office, and an evaluation or audit office could be set up, and all planning responsibility given to that vice-president. Concurrent with this organizational change, an information system should be developed to support the data requirements of planning, and procedural changes should be made to implement planning through program-budgeting rather than the traditional procedures. Such a "turn-key" approach requires a significant investment and, frequently, outside assistance.

An evolutionary approach may be better. Program budgets parallel current budget formats using cross-overs. Studies are used to define a single set of organizational objectives, and revised procedures are developed to use program change proposals in lieu of budget justifications. The information system is gradually modified to support the broader data requirements of PPBS. While the evolutionary approach requires additional resources because of parallel operation, it permits the organization to assimilate PPBS technology.

Again, the question of implementing PPBS can be answered only in the context of a specific organization. The purpose here was to point out that there are different routes for implementing PPBS, and the institution should choose the one most likely to produce results.

The Next Step

Perhaps an overlooked advantage of the PPBS technology is the better understanding of the real nature of the art of management. Robert Hayes said:

> I believe that the greatest impact of the quantitative approach will *not* be in the area of problem *solving,* although it will have growing usefulness there. Its greatest impact will be on problem formulation: the way managers *think about their problems*—how they size them up, bring new insights to bear on them, relate them to other problems, communicate with other people about them, and gather information for analyzing them. In this sense, the results that "quantitative people" have produced are beginning to contribute in a really significant way to the *art* of management.[15]

This improvement may be the most significant value of PPBS.

Frederick dew Bolman, describing the administrator as a leader and statesman, admonished:

> The college and university administrator must know not only how to assess his institution in financial terms with unit costs and program budgeting analyses. He must learn . . . cost-benefit analysis. This is an educator's task. . . .

---

[15]Ref. 13, p. 108.

> What hard evidences have we to present to the federal government, state legislatures, corporations, and individuals that we are really effective and efficient?[16]

In summary, then PPBS can be viewed two ways. As a system for planning and control, PPBS may be expensive and difficult to implement. Thus, an institution should be rightfully cautious in trusting its future to an abrupt implementation of PPBS. But the technology associated with PPBS may significantly improve the *art* of management by improved insight into the higher education process. For this reason, an administrator would be negligent if he did not invest in the time to learn about PPBS and its technology.

---

[16]Ref. 14, p. 182.

REFERENCES

1. Post, A. Alan, *Analysis of the Budget Bill of the State of California,* Joint Legislative Budget Committee, Sacramento, California, March 1, 1969.
2. Novick, David (ed.), *Program Budgeting: Program Analysis and the Federal Budget,* 2nd ed., Harvard University Press, Cambridge, Massachusetts, 1967.
3. Marschak, Jacob, "Economics of Inquiring, Communicating, Deciding," *American Economic Review,* Vol. LVIII, No. 2, May, 1968, pp. 1-18.
4. Marschak, Jacob, *Efficient Choice of Information Services,* Working Paper No. 136, Western Management Science Institute, University of California, Los Angeles, May, 1968.
5. Dreyfuss, John, "State Colleges to Lose Faculty Research Funds," *Los Angeles Times,* November 29, 1969, Part II, p. 2.
6. Eurich, Alvin C. (ed), *Campus 1980,* Delacorte Press, New York, 1968
7. *Planning, Programming, Budgeting and Systems Analysis Glossary,* U. S. General Accounting Office, Washington, D. C., January, 1968.
8. Haggart, S. A., S. M. Barro, M. B. Carpenter, J. A. DeiRossi, and M. L. Rapp, *Program Budgeting for School District Planning: Concepts and Applications,* The RAND Corporation, RM-6116, Santa Monica, California, November, 1969.
9. Greenhouse, Samuel M., "The Planning-Programming-Budgeting Systems; Rationale, Language, and Idea-Relationships," *Public Administration Review,* Vol. XXVI, No. 4, December, 1966, pp. 271-277.
10. Keller, John, "Higher Education Objectives: Measures of Performance and Effectiveness," *Management Information Systems: Their Development and Use in the Administration of Higher Education,* Western Interstate Commission for Higher Education, Boulder, Colorado, October, 1969, pp. 79-85.
11. Young, Michael E., *Program Budgeting: An Applied Model* (Master's Thesis), School of Business, San Fernando Valley State College, Northridge, California, January, 1970.

12. Smart, John M., *Feasibility and Desirability of Eliminating Lower Division Programs at Selected Campuses of the University of California and California State Colleges,* California Coordinating Council for Higher Education, Sacramento, California, 1966, p. 47.
13. Renetzky, Alvin, and Phyllis Ann Kaplan, *Standard Education Almanac, 1969,* Academic Media, Inc., Los Angeles, California, 1969.
14. Chandler, Margorie O., *Higher Education, Earned Degrees Conferred: Part A—Summary Data, 1966-67,* National Center for Educational Statistics, U. S. Office of Education, Washington, D. C., 1968.
15. "A Search for Relevance," *The Harvard Bulletin,* Vol. 72, No. 1, September 15, 1969, p. 20.
16. Weathersby, George, *The Development and Applications of a University Cost Simulation Model,* Office of Analytical Studies, University of California, Berkeley, California, June, 1967.
17. Springer, Colby H., *MICRO-U 70-1: Training Model of an Instructional Institution, Users Manual,* Western Interstate Commission for Higher Education, Boulder, Colorado (to be published).

1627:2M:1070:EP

65:5M:270:GM:EP:2B62